- Continuing rule revision process for NR102/NR104 Water Quality Standards;
- Ongoing evaluation of the methodology for use designation assessments for 305(b) and 303(d) listings;
- Development of recreational use designation standards, criteria, assessment protocols and use assessments for lakes, rivers and Great Lakes shoreline miles;
- Continuing adaptation to changes in federal guidelines and reporting requirements related to these and other standards and water quality criteria issues;
- Ongoing development of a statewide strategic monitoring plan for all surface and groundwater related needs.

Long-term plans (2004-2006) for using data in WADRS for public outreach include developing "rivers pages" for each named river in the state, designed using a process now in in development for the Lakes Program. This process involves generating a rivers page "on-the-fly" from WADRS and other pertinent data systems that hold monitoring data stored at DNR. These pages will be available through WDNR's external website in the respective waterbody's "basin page" in 2006.

Impaired Waters Screening Criteria

http://dnr.gov.wi/water/wm/wqs/303d/303.htm

Waters identified as "impaired" under Section 303(d) of the Clean Water Act include those that have either quantitative water quality standards violations or aquatic life and/or fish consumption use designation problems combined with that water not meeting its codified water quality classification. Once a waterbody is on the impaired waters list, it is categorized according to the factors causing impairment. Within each category is a description of the strategy the Department may use in development and implementation of TMDLs.

2004 Methodology for Placing Waters on Impaired Waters List

As required by section 303(d) of the Clean Water Act, states are to submit a list of impaired waters to EPA for approval. WDNR has submitted a list to EPA every two years up to 2004. Wisconsin is operating under the same federal regulations as used in 1998 and 2002. The WDNR has posted its Methodology for Impaired Waters on its website.

Chapter 3: Rivers and Streams

Assessment Summary

In 2002 the state reported a total linear stream mileage of 57,698, which includes intermittent and perennial waterbodies. About 44 percent (24,442 miles), of these miles were assessed at that time, and only a portion of the assessed miles (about 30 percent) have been monitored since 1997. Assesssment decisions on the remaining 70 percent of assessed miles were based on evaluated data, or data more than five years old and/or from interpretation of field surveys or other data collected by external individuals or agencies.

Also, in 2002 WDNR reported all Wisconsin streams were assessed for fish consumption based on evaluated information. Due to the general fish consumption advisory for mercury, all waterbodies were assumed to not meet this designated use.

During the 2002 reporting period assessments for recreation or public water supply were not conducted. However, data gathering efforts through the Beach Program for Great Lakes shoreline health, as well as an inland water beach study, and through the state's Source Water Assessment and Drinking Water Program, will provide data for future use. Assessments will occur after pathogen water quality criteria have been developed and protocols for assessing public water supply and recreational uses are in place.

Data does exist for fish and aquatic life. Where waters are partially or not meeting designated uses,

the cause and source of the non-support is documented. Water quality problems in the state are most often the result of watershed-specific land use activities, with the exception of atmospheric deposition of mercury. The most prevalent water quality problems include the presence of mercury in surface water, habitat alterations, siltation, excessive nutrients (phosphorus) and materials that use up oxygen as they decay, limiting oxygen availability for aquatic life. The causes of these water quality problems include atmospheric deposition, polluted runoff, and hydrologic modifications such as ditching and wetlands destruction. Wastewater discharges contribute moderate to minor impairments to Wisconsin's streams. A stream reach may be degraded by more than one source, causing more than one problem, the cumulative effect of which can be significant.

River Management

The Department's Rivers Team oversees the implementation of the state's Rivers Strategy, Rivers Grants, and tracking of river management performance measures.

Rivers Strategy - Report Card

Going with the Flow: A Rivers Strategy to Protect, Preserve, and Restore Wisconsin's Flowing Waters brought a coordinated approach to the support of local river management in the state. This strategy integrated various ongoing river management efforts in the Fish Management and Habitat Protection Program, and provided the momentum to further develop an ongoing relationship with key external partners, such as the River Alliance of Wisconsin.

Strategy goals include: protecting and restoring riverine ecosystem integrity. Development around rivers systems and the use of rivers have significantly modified many rivers' physical and biological characteristics. Dams have been constructed and have converted free-flowing rivers into a series of impoundments. Systems have become fragmented. Land use practices have degraded water quality and increased the amount and altered the rate of sediment and nutrient flow in the systems. The integrity of the ecosystem (combination of the physical, biological, and chemical components) must be protected and restored to preserve the functional riverine system.

The second goal is balancing legitimate river uses with environmental needs. Decisions on multiple river uses like recreation, waste assimilation, power generation, water supply, irrigation, transportation, etc. must be made together to sustain both river continuity and socioeconomic benefits.

Third, enhancing the public's personal stake or sense of ownership of rivers, this includes participation of user/citizen groups is critical to the success of a river program. The state's River Grant Program has provided over $150,000 during each grant cycle to establish and support river organizations.

The strategy also includes developing a consistent and comprehensive approach that assures the effective and equitable protection and management of Wisconsin's rivers systems. Historically river management has been inefficient because of the lack of coordination or inconsistencies in the designated management approach. Identifying and protecting critical river systems by managing rivers according to their unique potentials and needs. Rivers differ in size, surrounding land, environmental and economic potential, threats, and protection needs

The Rivers Team strives for comprehensive management at the watershed level. To be most effective, working relationships with other agencies or groups must be formed to develop an integrated management plan that includes the entire basin or watershed and builds on existing efforts in river management. During 2002-2004 the Water Program developed a comprehensive data system to hold assessment and narrative data from the state's integrated management plans and field work. This system (WADRS), will make posting data online for public use much more efficient.

The strategy also calls for showcasing success stories based on realistic performance measures. Below are examples of high quality grant projects.

River Grant Program

The state's Rivers Grant Program supports community and nonprofit groups protect rivers by funding work that helps prevent water quality deterioration, restore fisheries habitat, and maintains

natural beauty. This initiative is seen as fundamental to whole ecosystem protection as the density of residential development and recreational uses along rivers increases coincidentally with the exhaustion of available lake sites. Local units of government and nonprofit, qualified river management organizations are eligible to apply for these grants. Between 1999 and 2002, $308,912 was awarded for 49 separate planning grant projects and $419,599 was awarded for 11 separate management or implementation projects. Many additional dollars have been made available to rivers organizations during the years 2003 and 2004.

River Planning Grants are designed to help with river organization development, to support information and education work and local, community-based assessments of water quality, fish and aquatic life, and finally to help conduct nonpoint source evaluations. The grant program provides a 75% state share maximum, up to $10,000 per grant.

River Management grants are designed to support purchase of land or easements, development of local ordinances for river protection, and restoration of in-stream or shoreland habitat. Again, this program provides a 75% state share maximum, up to $50,000 per grant.

Performance measures for grants helps evaluate the effectiveness of rivers program. While the department continues to pursue ecosystem based performance measures that focus on numerical relationships between watershed activities and resulting riverine condition. Only recently has research been completed that describes such a relationship (See Science and Innovation in Water Management). “Useful efforts” is the term used to describe functions deemed valuable in restoring or maintaining sound riverine ecosystems. The rivers grants program lists “Useful Efforts” in its roster of eligible work projects and in the criteria used in ranking applications. “Useful Efforts” performance measures for planning include: the number of planning grants, number of publications, or the number of planning groups formed. For management grants examples include number of acres purchased or easement acquired lands, number of nonpoint source practices established, or river restoration projects completed. More expansive criteria — for example, evidence that DNR has participated effectively in preparation of a mission, goals and strategy for a local rivers organization — are also being developed. For river management grants, performance can be measured by pre- and post-monitoring and evaluation of whether the grant achieved its stated goals.

Highlighted Projects

During the reporting period, a number of grants were funded and implemented to enhance the capacity of local river organizations. Among those funded, the Rock River Headwaters, Inc., Upper Sugar River Watershed Capacity Building Project, and the Black Earth Creek Watershed Association made significant strides in increasing local knowledge of and support for watershed restoration.

The nonprofit group, Rock River Headwaters, Inc., focuses its efforts on the Upper Rock River Basin’s headwater areas including the Horicon Marsh. The group was actively involved in development of the Rock River State of the Basin Report, completed in 2002 by hosting stormwater, groundwater and surface water protection discussions for the basin.

The Upper Sugar River Watershed Capacity Building project has received funding through the Rivers Grant Program for three consecutive years. In 2000 the Dane County Parks Department received a $10,000 grant from the WDNR for three nonprofit organizations (the Deer Creek Sportsman’s Club, the Friends of Donald Park, and the Upper Sugar River Watershed Association (USRWA)). Each of the three nonprofits set goals to carry out restoration work. For example, Friends of Donald Park formed to implement the goals of the Donald Park Master Plan, which contains 2.5 miles of the Sugar River Headwaters (Mt. Vernon Creek, Deer Creek and Frye’s Feeder). The USRWA earned the 2002 Water Champion Award, presented by the Dane County Lakes and Watershed Commission and the 2002 Stewardship Award (nonprofit category) presented by the Natural Heritage Land Trust. In 2003, the USRWA implemented a variety of public educational efforts including radio, TV and print adds about being “RiverSmart,” providing tips and pointers for protecting river quality.

Friends of the Pheasant Branch also received river grants in consecutive years, with funding allocated toward advancing its administrative functions, organizing volunteers for ecosystem restoration projects, and obtaining funds from alternative sources (leveraging) for the purchase of sensitive areas in the watershed. This high quality Friends organization also carried out educational efforts and

promoted low impact development and conservation practices through its participation in the Pheasant Branch Watershed Task Force.

Sampling on the South Fork Hay River in Wisconsin's driftless area, southwest ecoregion

The relatively "pristine" ecosystem of the Jump River benefitted from the extraordinary efforts of the Friends of the Jump River, which carried out monitoring, networking, resource preservation and educational outreach work. This friends group successfully fought for the placement of 8000 acres of Price County Forest (involving 20 miles of Jump River frontage) into non-motorized status. Among a long list of accomplishments, the Friends' president is working with DNR to help develop additional citizens groups around other valuable water resources in the Chippewa Basin. The Friends also developed a strategic plan for management of the river.

The Black Earth Creek Watershed Association (BECWA) initiated a number of activities through the grant program including capacity building and leveraging (a variety of successful local networking contacts were made), assisting in local decision making, and educational efforts. The BECWA contributed to development of the Lower Wisconsin Basin Plan, the Dane County Open Space Plan and the Black Earth Creek Fishery Area Master Plan.

The BECWA and other dedicated, motivated friends groups illustrate why the Rivers Grant Program was formed – to enhance stewardship of river systems statewide through education, networking and providing start-up money to talented individuals and organizations.

Dam Removals

Dams negatively affect riverine fish communities by blocking migrations, altering natural stream flows and temperature regimes, and fragmenting critical habitats. Moreover, dams are typically constructed across high gradient river reaches, thus eliminating riffle habitats that function as spawning and nursery areas for native fish species. Consequently, substantial fish community shifts typically occur following dam construction, such as the replacement of sensitive riverine species by tolerant lentic species, the loss or degradation of fish migrations, and the extirpation of species due to the fragmentation of critical habitats. To mitigate the negative effects of dams on riverine fish communities, dam removal is considered a management option to reconnect and restore these fragmented habitats. However, despite the increasing use of dam removal as a restoration tool, there is a need for more quantitative biological information on how these systems recover after dams are removed. Understanding how riverine fish communities respond following dam removal will help resource managers and communities make sound decisions on future dam removals.

In Wisconsin, dams are a ubiquitous part of the drainage network as over 3,700 dams have been constructed in the state since European settlement. Most of the dams are small, low-head structures that were originally built in the mid- to late-1800s to provide hydropower to small textile, paper, and saw mills. Because of their age, many of these small dams are now dilapidated or non-functioning and are no longer economical to maintain. Consequently, many small dams are slated for removal, which in many cases is much less expensive than dam repair, and is thought to have aquatic ecosystem benefits. Recently, Wisconsin has been a national leader in dam removal, with over 60 small dams removed in the last 30 years (excerpted from Catalano, Matthew J., 2004, The Effects of Dam Removal on the Fish Community and Habitat of the Baraboo River, Sauk County, Wisconsin, WDNR South Central Region).

http://www.dnr.state.wi.us/org/water/fhp/rivers/index.htm

One interesting finding by the River Alliance of Wisconsin is that dam removal costs are often over-estimated. Removing the Willow Falls Dam on the Willow River cost 27% less than the original removal estimate ($450,000 rather than $622,000). On the Baraboo River, removing the Waterworks Dam cost 35% less than originally estimated ($240,000 instead of $387,000) And removing theMounds Dam on the Willow River cost 85% less than the original estimate ($170,000 instead of $1.1 million).

Several dam removals throughout the state are in the planning stages or have recently occurred. The following examples summarize some of the issues involved in Wisconsin dam removals.

Token Creek Watershed Project

The Token Creek Watershed, a 27-square mile drainage area in the Rock River Basin, is the focus of intense restoration efforts following the removal of a dam in 1998. This small watershed likely sustained a native brook trout fishery prior to European settlement, prior to the construction of a grist mill dam 150 years ago. Over the years, the dam's original function as a grist mill changed to that of supporting recreational activities. However, when the dam failed in 1994, springs discharging greater than 4,000 gallons of cold water per minute to Token Creek were exposed, raising the question of how the waterbody should be managed. The Token Creek Coalition subsequently raised $1 millon to purchase the dam and surrounding reservoir from the Token Creek Inland Lake District.

Restoration of the channel and habitat, preservation of the springs, and reduction of polluted runoff to Token Creek continue today. In 2004, channel restoration will begin through funding from the Trout Stamp Act, Natural Resource Conservation Service, U.S. Fish and Wildlife Service, and the state's Yahara-Monona Priority Watershed Program. This work includes restoration of the Harbison (Pederson) Branch, creation of a sediment trap downstream of the dam, notching the Culver Springs impoundments and beginning the channel restoration. With the addition of other habitat improvements below the dam, at least 7 miles of stream will be re-established as a brook trout fishery. Dane County, WDNR and the City of Sun Prairie have also been working to encourage development that is more sensitive to this cold water system. For example, new developments use techniques to encourage stormwater infiltration rather than conventional retention ponds, which tend to lead to high water temperature and change in the aquatic habitat.

Borah Creek, Grant County is a high quality water in SW Wisconsin. Portions are classified as trout water and exceptional resource water.

Baraboo River Restoration

The Baraboo River flows 120 miles from its headwaters near Hillsboro to a confluence with the Wisconsin River south of Portage, encompassing 650 square miles. The river drops 45 feet as it flows through the City of Baraboo. This concentration of relatively steep gradient was recognized by early settlers and used to generate mechanical power beginning 1837, when dams were constructed in this reach of the river. Dams formerly on this stretch of the river included: the Linen Mill Dam (removed in 2001), the Waterworks Dam (removed in 1998), the Oak Street Dam (removed in 1999), and the LaValle Dam (removed in 2001).

These dams negatively affected the Baraboo and Wisconsin River ecosystems by restricting the movement of game and forage fish species, as well as blocking valuable spawning and nursery

Baraboo River after removal of the Linen Mill Dam, courtesy of Konstantine E. Margovsky

areas for fish migrating from the Wisconsin River. This habitat fragmentation transformed the rapids from a fast-moving stream with healthy fish populations to a series of sluggish impoundments choked with sediment, excess nutrients and degraded habitat.

In response to the potential importance of these systems to the state, many agencies, non-profis and citizens are working to restore the aquatic and riparian resources.

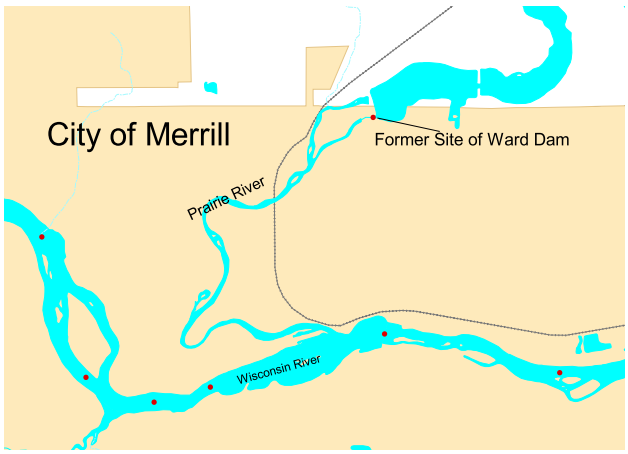
Today the dams have been removed and partners are monitoring the system to better understand the impact of dam removal on the fishery and on water quality. Recently, several fish species such as the Emerald Shiner and the Lake Sturgeon have either been observed and/or captured through surveys upstream of the former dams. This is a sign indicating system recovery.

Prairie River Dam

The Prairie River is an outstanding trout stream located in the Wisconsin River Basin. This high quality resource has a mean annual flow of about 180 cubic-foot-per second (cfs) and hasthe state record for brook trout (9 pounds,15 ounces). The Prairie once hosted four dams, now all structures have beenremoved after 110 years of hydromodification.

The Ward Dam was the last of four dams built to provide water for log drives in the late 1800's, and the last dam to be removed. Significant restoration work has occurred on the Prairie River to improve and restore habitat in the past two years. Restoration efforts have involved adding 1200 large boulders, 7000 trees, 225 pieces of large woody habitat, restoration of six wetlands, implementing erosion control measures, channel modifications, and installing nesting boxes. Extensive public information efforts have also occurred.

Figure 17: Prairie Creek System



Recently, 100 acres of land was donated to the City of Merrill by International Paper, which previously owned the Ward Dam. WDNR, the city and International Paper have cooperatively designed and implemented a stormwater management system that routes stormwater through more than 3000 feet of ponds and wetlands, created during the dam removal, before flowing into the Prairie River. The total cost for the restoration work, including donations by Trout Unlimited, $52,000 for two miles of stream that had been under water for over 120 years.

http://www.wisflyfishing.com/friends/HTM/Prairie.htm

http://www.wisconsinrivers.org/SmallDams/ward_removal.html

Shopiere Dam

The Shopiere Dam, constructed across Turtle Creek, which is an Exceptional Resource Water and one of the finest small-mouth bass rivers in Southern Wisconsin, was located in the Town of Turtle, Rock County. The dam was built in 1848 as a rock and timber structure to power a grist mill. In 1925 the dam was reinforced with masonry and concrete, consisting of a 120-foot long, fixed-crest spillway with a structural height of 13.4 feet and a hydraulic head of 7 feet.

The owner of the dam left Wisconsin in the 1970s. Rock County owns a park immediately adjacent to the site of the former dam and tax-delinquent land. Although though the area was posted with signage indicating the flowage was not part of the public park, swimmers were known to cool off in the 'water fall', swim under the dam into the structural voids, and to jump off the spillway into the scour hole. This use posed a significant safety hazard.

http://www.wisconsinrivers.org/

The dam also obstructed fish movement. Studies showed that the number of small-mouth bass were greater below the dam, with an average of 85 fish per mile, versus above the dam with an average of only 50 fish per mile. The threatened gravel chub (*Erimystax x-punctata*), ozark minnow (*Notropis nubilus*), and the greater redhorse (*Moxostoma valenciennesi*) were documented downstream of the dam, but not upstream.

Recurrent failures in 1943, 1973, 1983 and 1993 led to the development of the Shopiere Dam Committee. The dam was completely removed by 2000 at a cost of $82,000. Post-dam removal studies show fisheries improvements upstream of the dam including the presence of the three threatened species. Recent surveys show walleye and channel catfish present in multiple year classes, as well as other species not found in prior surveys.

Franklin Dam Removal

In 2000 and 2001 the WDNR removed the 148-year old Franklin Dam located on the Sheboygan River. The first step in dam removal was removing the gates and breaching a portion of the dam to reduce impoundment water levels; this work helped stabilize exposed sediment. Funding for the removal came from the Wisconsin Abandoned Dam Fund and two grants from the Great Lakes Protection Fund, one of which was obtained by the River Alliance of Wisconsin, a nonprofit organization. Today, the channel is still forming and will not be completely stable for some time, perhaps 10 years. Rivers are dynamic systems in constant search for “stability” (a balance of flow, sediment, energy, etc.). While there is still “head cutting” occurring, which means the channel bottom is cutting down to a better slope and there is a point that is slowly moving upstream where a form of clay is slowly eroding down to the original channel bottom, these are natural processes that will ultimately result in a more stable, sustainable system.

Looking downstream where the Franklin Dam once stood.

Big River Management

Mississippi River

Interstate Coordination

The Upper Mississippi River (UMR) is a resource of major importance to Wisconsin. Forming the boundary between Minnesota, Iowa and Wisconsin - and sharing management responsibilities for this Upper Mississippi segment with these states and federal agencies — WDNR participates in numerous multi-state planning, monitoring, and restoration projects involving this major resource, including the Environmental Management Program (EMP), navigation studies, environmental pool plans, channel maintenance plans, water level management and other planning activities.

During 2002-04, Wisconsin participated on the Upper Mississippi River Basin Water Quality Task Force, coordinated by the Upper Mississippi River Basin Association (UMRBA). This task force, comprised of water resource management administrators and staff from the five UMR basin states (Minnesota, Wisconsin, Illinois, Iowa and Missouri), met regularly to improve coordination of water resource management activities on the Mississippi. Issues such as water quality concerns related to hypoxia in the Gulf of Mexico, water quality standards, monitoring protocols and plans, assessment procedures, impaired waters listing 303(d), development of total maximum daily loads, etc. have been discussed. In 2003, the Task Force developed a Memorandum of Understanding, signed by the five UMR basin states, for the establishment of consistent assessment reaches on the UMR for use in water quality evaluations and reporting requirements under the Clean Water Act - 305(b) and 303(d). Wisconsin has begun to incorporate these changes in to its assessment procedures.

In 2003, Wisconsin assisted Minnesota in the evaluation of water quality data for their 2004 impaired waters listing for the Mississippi. In addition, Wisconsin worked with the Upper Mississippi River Conservation Committee Water Quality Technical Section in the development of proposed water quality criteria to protect submersed aquatic vegetation in the UMR. This proposal is currently being reviewed the UMRBA Water Quality Task Force.

Mississippi River Water Level Management

A two-year water level reduction demonstration was held in Pool 8 of the Upper Mississippi River during the summers of 2001 and 2002. Through this demonstration almost 2000 acres of mud and sand flats were exposed to provide favorable growing conditions for aquatic vegetation. Assessment monitoring is ongoing to determine the exact extent of aquatic plant bed expansion and the length of time vegetation will linger after reflooding. Initial aquatic plant response appears to indicate this is a positive habitat restoration tool for the Upper Mississippi River. A task force of natural resource managers has begun planning to conduct a similar demonstration on Upper Mississippi River, Pool 5, in 2005.

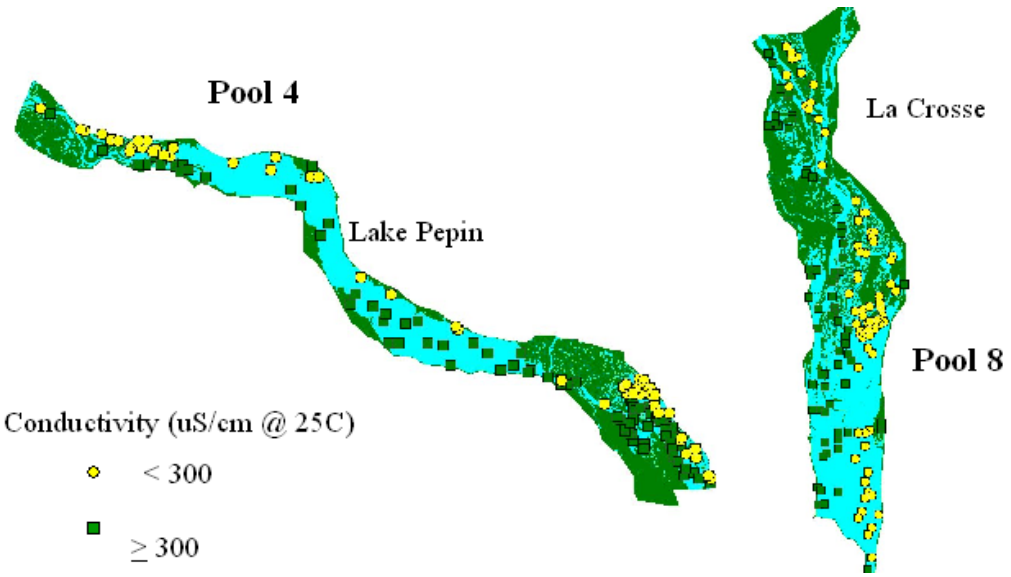
Figure 18: Pool 8 July 2001 to August 2002-Emergent vegetation response to a pool-wide drawdown, Mississippi River. Photos from Kevin Kenow, USGS.

The WDNR has participated in the Corps of Engineers Navigation study since 1991. As a result of a congressional inquiry the study was restructured in 2001, to include an equal emphasis on commercial navigation and the ecosystem integrity of the Upper Mississippi River. The draft Feasibility Report and the Environmental Impact Statement are scheduled for release in 2004. Tentative recommendations from the study will likely include improvements at 12 locks and other small scale efficiencies with a 50-year cost estimate of $2.3 billion. Ecosystem restoration tentative recommendations will likely include a wide variety of restoration tools with a 50-year cost estimate of $5.4 billion. The final report including review by the National Research Council will to be sent to the Chief of the Army Corps of Engineers in November 2004. If this plan is authorized and funded by congress, adaptive management principals will be applied to commercial navigation efficiencies and ecosystem restoration and will require periodic evaluation to move to the next phase.

Long Term Resource Monitoring Program (LTRMP)

In 2003, the WDNR's LTRMP worked on teams with staff from the other state field stations and USGS Upper Midwest Environmental Sciences Center to provide a 10-year summary of all monitoring components. Comprehensive temporal and spatial analyses of fish, vegetation, macroinvertebrates and water quality were performed. Results have been summarized and draft reports have been prepared. These reports will be published and released in 2004. These multi-year summary reports will be supplemented by more detailed appendices containing all analysis results on CD and by peer-reviewed articles in scientific journals. LTRMP monitoring was reduced in 2003 due to funding shortages and work centered on data analysis. The Wisconsin field station collected a full complement of vegetation monitoring in Pool 8 and aided in the evaluating aquatic vegetation response to water level management activities implemented in 2001 and 2002. In 2003, the Wisconsin field station also participated with USGS and the Iowa Field Station in conducting water quality monitoring (including light penetration) to aid in constructing of predictive models for submersed vegetation. In addition, limited fish monitoring activities were conducted.

Figure 19. LTRM 2001 Spatial Analysis. Spatial analysisof stratified random samples collected by the Long Term Resource Monitoring Program reveal strong persistent lateral gradients below major tributary inflows to the Mississippi River during spring periods. Data are from April 2001.



Freshwater Mussels

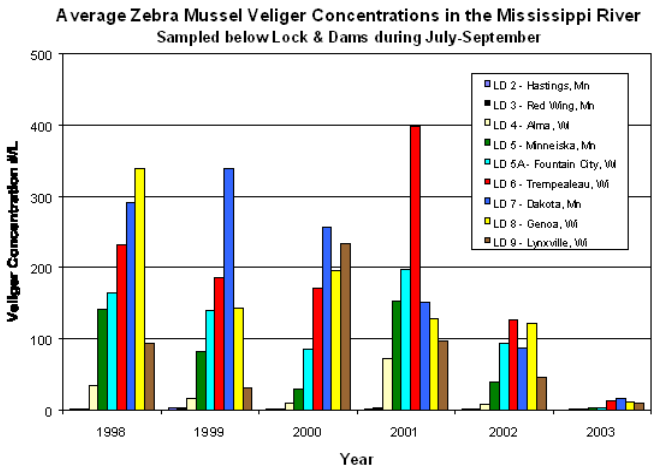
Freshwater mussels are an important biological component of large river ecosystems. They are generally considered good indicators of water quality since they are often the first group of organisms to be eliminated or lost from a compromised waterbody. In the upper Midwest, about one-third of the fauna is listed as endangered or threatened by Federal and State agencies. These lists are comprised of mostly large river species.

Introducing juvenile endangered mussels into the Black River, Wisconsin.

In 2003, Wisconsin participated with other State and Federal agencies in propagation of the federally endangered higgins eye freshwater mussel. The purpose of this multi-agency project, lead by the U. S. Army Corps of Engineers, is to mitigate for loses of freshwater mussels from the invasion of the non-indigenous and invasive zebra mussel. The final objective of this program is to establish or supplement endangered mussel populations in rivers or reaches of rivers where zebra mussels are absent or at low population densities. Monitoring of the success of this unique program is ongoing and initial findings are promising. Wisconsin also continues to actively participate in two federal endangered species Recovery Teams for the higgins eye and winged mapleleaf mussels in cooperation with the U.S. Fish and Wildlife Service. Host fish for the winged maple mussel have recently been discovered and plans are being prepared for the reintroduction of this very rare mussel into historically occupied locations.

WDNR recently surveyed large tributary streams to the Mississippi River for mussel and mussel habitat. WDNR evaluated the potential of these streams for mussel introduction or re-introduction. Suitable habitat conditions were found on the lower Chippewa River and limited conditions were found on the lower Black River. In both these streams, high levels of bedload were found to be limiting mussel populations. WDNR also continued its long-term mussel monitoring program begun in 1985. One location on the Lower Wisconsin River continues to experience sharply declining mussel populations. Population densities have declined 70 percent since 1988, with fewer young recruits and lower species richness. One of three locations on the St. Croix River has shown a steadily declining mussel fauna, while the remaining two appear to be stable. Reasons for these declines are unknown, although zebra mussel invasion has been extensive.

Figure 20:



WDNR cooperated with members of the Upper Mississippi River Conservation Committee in the formulation of the “Conservation Plan for Freshwater Mussels of the Upper Mississippi River System.” Further, WDNR is assisting UMRCC in a revision of “Freshwater Mussels of the Mississippi River,” a popular information brochure for river managers and the public.

Contaminated Sediment Management

The nature of pollution in aquatic systems often results in the heaviest concentration of contaminants in either or both the waterbody's aquatic life and its sediment, or the "mud" that settles to the bottom. Sometimes, when sediment behind a dam is dredged or when known sites of municipal or industrial discharge are investigated, contamination is found. When contaminated sites are identified, the environmental and health risks are assessed, and integrated remediation efforts are carried out by scientists and engineers both internal and external to the Department. The following text illustrates some of the issues and concerns and even some of success stories in identifying, understanding and removing sediment from aquatic systems.

Contaminated Sediments at Former MGPs

Former Manufactured Coal Gas Plants (MGPs) produced gas from coke from the early 1800s through the1950s. MGPs used coal as a feedstock, producing large quantities of byproducts during their operation. Waste byproducts included coal tars, sludges, oils and other chemicals, coal tar being the main byproduct of the gasification process. The plants typically operated in confined areas, and used the nearest convenient outlet for waste disposal, which was often a nearby surface water. The result is a scattering of contaminated MGP sites throughout the state.

Coal tar is the primary waste at MGP sites, but is usually a mixture of polycyclic aromatic hydrocarbons (PAH), such as benzo-pyrene, naphthalene, anthracene, acenaphthene and phenathrene; phenolic compounds (phenol and methylphenols); light aromatic compounds (benzene, toluene and xylenes); miscellaneous organics (dibenzofuran), and small quantities of inorganic compounds (iron, lead, copper, zinc, sulfides, cyanides and nitrates). Coal tar is heavier than water and migrates downward, where it resides in an immobile state or spreads slowly, as a continuous source of contamination through the solubilization of contaminants over time. Once the waste products enter the environment, they do not degrade readily and are threat to aquatic, wildlife, and human health. For this reason, WDNR actively pursues remediation of contamination from MGPs.

Ashland Coal Gas

The Ashland Coal Gas site is located in Ashland Harbor, Ashland County, which is tributary to Lake Superior. The Excel Corporation contaminated 10 acres of surface water and groundwater. Contamination was first detected by WDNR 10 years ago. Since that time WDNR and the Excel Corporation have investigated the site, finding extremely high levels of coal gas waste. The USEPA, now involved through the Superfund Program, is conducting additional risk assessment work to further quantify human health and ecologial risk. The contamination is also shore-based; there is known on-land subsurface contamination of PAHs in volumes potentially larger than that found in the surface water sediment.

Contaminated Sediments at Former Industrial Sites

Gruber's Grove Bay

Gruber's Grove Bay, a 20 acre-site, is located on Lake Wisconsin, adjacent to the former Badger Army Ammunition Plant near the City of Baraboo in Sauk County. Sampling in the Bay in 1999 indicated elevated levels of mercury, lead, copper, chromium and nickel. The contaminated sediments were the result of discharges from ammunition production at the former plant. Seventy-five thousand (75,000) cubic yards of mercury contaminated sediments have been hydraulically dredged and landfilled at a cost of $6 million. During dredging operations, the use of a silt curtain was implemented to contain contaminants in the bay. In addition to this work by the WDNR and the Department of Army, USEPA, UWEX, and citizen volunteer groups contributed to cleanup efforts. Remediation was completed in November 2001. However, post-remediation monitoring indicates that sediment underlying the entire extent of Grubers Bay still contains levels of mercury and other metals at levels exceeding the previously identified sample results. Unfortunately, results also indicate that the levels found exceed WDNR's site specific sediment toxicity guidelines. Cooperative efforts with the Army in 2003-04 resulted in further sediment and toxicity testing and development of alternatives for future

action.

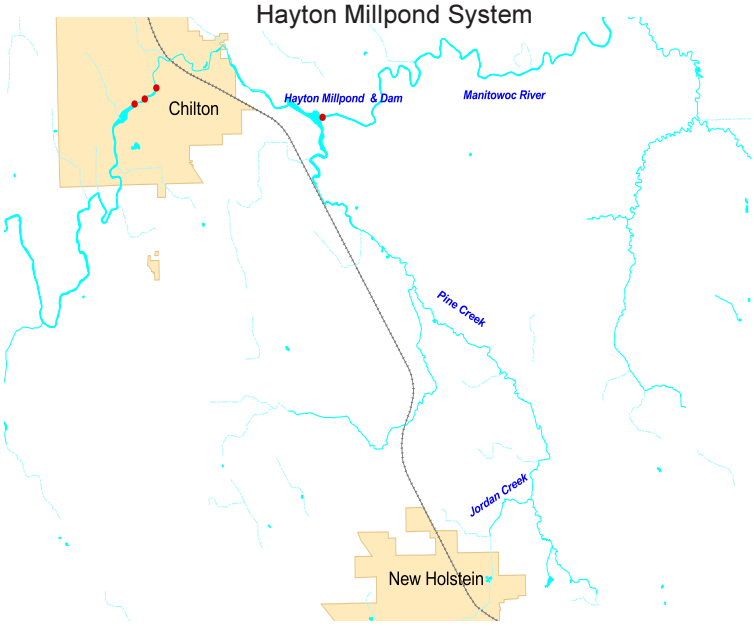
Wausau Steel Corporation / Rib River Oxbow

Wausau Steel Corporation performed battery reclamation adjacent to the Big Rib River near Wausau in Marathon County. Runoff from the battery recycling operation reached a cutoff oxbow of the Rib River, resulting in sediment contaminated with lead and zinc. A feasibility study indicated that "capping" was the appropriate remediation for this four-acre site. This work was accomplished in 1997 by placing geo-textile fabric and sand on top of the ice cover and letting it settle over the sediments as the ice melted. Cobble "islands" were also placed on the cap to provide habitat for aquatic life. The approximate cost of remediation was $400,000. Post-capping monitoring indicated that beneficial aquatic habitat has developed in the capped area and that healthy aquatic life is re-establishing. However, recent investigations by WDNR indicate that the geotextile membrane cap may be failing in some areas of the oxbow. Further investigations and followup work is needed; WDNR will pursue this work if funding is available.

Hayton Mill Pond

Contamination at Hayton Mill Pond in Calumet County, near the Village of New Holstein, was first identified by the Department in the early 1990s. In the late 1980s fish surveys conducted by WDNR and USEPA found fish in Hayton Millpond, a small impoundment on the south branch of the Manitowoc River, were contaminated with PCBs. Subsequent investigations found PCB contaminated sediment and fish in Pine Creek, a southern tributary to Hayton Millpond, and Jordan Creek, a feeder stream to Pine Creek. In 1991, the most stringent fish consumption advisory (do not eat) was issued for these waterbodies (Baumann, James. 2001. PCB Removal and Management in the Hayton Area Remediation Project, Wisconsin Department of Natural Resources).

Figure 21: Jordan, Pine and Hayton Millpond System



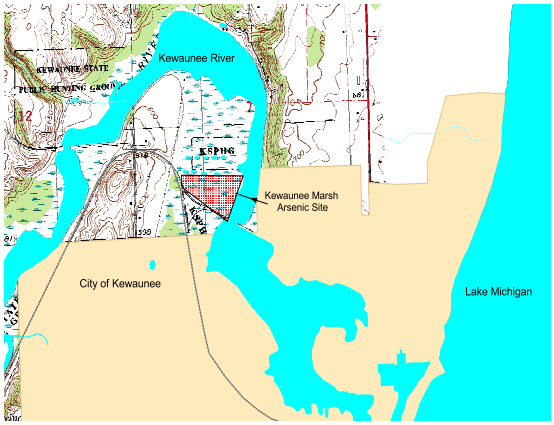
Tecumseh Products, an engine manufacturer, is responsible for the contamination. Investigations revealed that the PCBs were probably released in the mid-to-late 1960s. The initial release of the PCBs has been exacerbated by the transport of this organic contaminant as it attaches to sediment and organic matter -- and as the contaminated water, sediment and organic matter moved through the City of New Holstein stormsewer system. The pollution affects 20 miles of surface water, floodplain and wetlands. Of particular concern is the Killsnake Wildlife Area immediately downstream of the millpond, northeast of the Jordan Creek, Pine Creek and Hayton Millpond system.

WDNR and Tecumseh Products developed cleanup plans and implementation began in 2001. Sediments with the most contamination were removed and landfilled at a cost of $1 million. To evaluate the success of remediation, chemical and biological monitoring was conducted prior to remediation and will continue through the completion of the clean-up process. Remediation is being conducted by WDNR with the City of New Holstein, Calumet County, USEPA, and United States Geological Survey (USGS). In 2004, the second phase of remediation began along Jordan Creek and Pine Creek, covering 2.5 miles of stream and removing contamination from the sediment, streambed and banks of the waterbodies.

Kewaunee Marsh

Three acres of the Kewaunee Marsh in Kewaunee County is contaminated due to a Central Wisconsin Railroad car spill in the 1940's. This spill resulted in arsenic contamination of surface water and groundwater in this three-acres of wetland. As an interim remedy to reduce human and waterfowl exposure, a geo-textile liner and several feet of wood chips were used to cap the contaminated wetland. The perimeter of the contaminated area was also securely fenced to eliminate public access, and to safeguard human health. Biological and chemical monitoring was conducted prior to the remediation and is currently being conducted to ensure that the movement of the contaminated groundwater plume does not continue to pollute the river. In 2003 a Site Assessment and Remedial Actions Alternative Report, funded in part by USEPA, was completed. Currently, a feasibiilty study is underway to evaluate an innovative remediation technology using a permeable reactive barrier. This is an *in-situ*, or in-place, passive system which will allow the simultaneous flow of groundwater through the membrane while removing the arsenic. Cooperative work between WDNR and and the responsible party will implement remedial actions in the next two years.

Figure 22.
Kewaunee Marsh Site



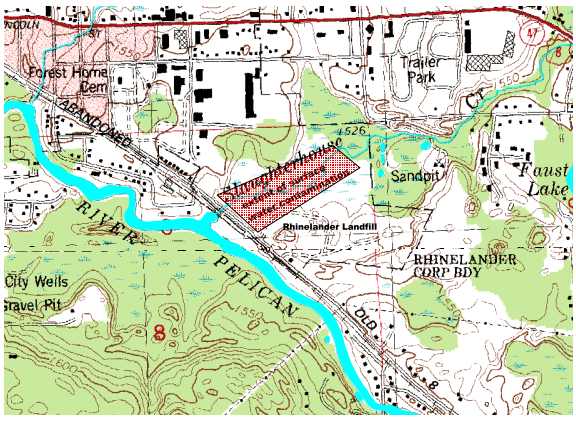
Ansul Corp / Menominee River

The Menominee River in Marinette is the location of 20 acres of arsenic contamination from the Ansul Corporation, a chemical manufacturer of flame retardant materials. On-site storage of wastes resulted in contamination of groundwater and of sediments in the Eighth Street boat slip, the ship turning basin, the Menominee River and in Green Bay. Remediation so far has consisted of removing contaminated sediment at the boat slip and sealing off the slip. During this removal work, silt curtains and sheet piling were used to isolate contaminated groundwater and prevent it from polluting other areas. Additional investigations of the turning basin are needed to determine a future course of action. WDNR, Ansul, USEPA, and USFWS have been involved in the remediation.

Rhinelander Landfill

An abandoned landfill in the City of Rhinelander in Oneida County is the source of pollution of surface water and groundwater pollution by ammonia and, perhaps also metals (see figure 23). The site is near Slaughterhouse Creek and Pelican River and the identified pollutants have degraded these nearby resources. The contamination was first discovered in 1996, and the Department, as well as the City of Rhinelander, has spent about five years investigating the site. Monitoring has focused on changes in water quality, toxicity studies, and degree of contamination. This sampling data is under review, as alternatives are considered to address the contaminated groundwater input into the Slaughterhouse Creek sloughs.

Figure 23: Slaughterhouse Creek Site



Moss-American/Kerr-McKee

Moss-American (now the responsibility of Kerr-McKee Corporation) was a chemical manufacturing industry that treated wood by a creosoting process from 1921 to the mid-1970s. Wood products were treated with a mixture of fuel oil and coal-based creosote. Moss American, which was located on the Little Menomonee River in Milwaukee, caused the contamination of sediments, groundwater, and surface water of a two-mile section of the river. The U.S. EPA has designated Moss-American as a Superfund site and has taken the lead on coordinating the clean-up investigation. To date, the U.S. EPA, WDNR and Kerr-McKee, have each spent seven years working on this project. The site remediation began with the removal of 137,200 tons of contaminated soil on the Moss-American property. The next stage involves rerouting about

six miles of river in five stages or segments so that remediation of the contaminated sediment can take place. The re-route will include a new river channel and plants and trees that stabilize the new channel and bank. The first segment of the site remediation, between Brown Deer and Bradley Roads, has been completed. The next segment will be conducted later in 2004.

Murphy Oil Refinery / Newton Creek

Murphy Oil Refinery, located in Superior, is responsible for the contamination of one river mile of Newton Creek, a tributary to Lake Superior. Investigations by WDNR showed that the 1.5 mile length of Newton Creek and about 17 acres of Hog Island Inlet connected to Superior Bay are contaminated by residual petroleum oils. Contamination of sediments by oil and grease and PAHs was discovered nearly 20 years ago. In 1996 Murphy Oil excavated sediments from the headwaters impoundment and a portion of Newton Creek. In 2003, WDNR excavated and disposed of 5,000 cubic yards of petroleum-contamianted seidments and floopdplain soils from Newton Creek. Over the past seven years, the WDNR, Murphy Oil, and the City of Superior have cleaned up the two-acre impoundment at the headwaters of Newton Creek, and the majority of creek. Additional investigations are presently underway for dredging Hog Island inlet in 2005.

Koppers Industries, Inc. / Crawford Creek

Koppers Industries, Inc. is a chemical manufacturing plant located on Crawford Creek in the City of Superior. Crawford Creek is tributary of the Nemadji River which flows into Superior Bay. The facility treated wood with pentachlorophenol and creosote and discharged waste into the creek, which resulted in contamination of the sediment and overflow areas along a drainage ditch from the facility. Koppers Industries has undertaken corrective measures related to the soil and groundwater contamination at the site. Koppers Industries (Beazer East, Inc.) has the goal of cleaning soils, groundwater, and a portion of the drainage ditch by 2005.

Figure 24: Newton Creek,Hog Island Inlet